Aircraft Hydraulic Fluid Purification

Reuse of hydraulic fluid can save the USAF $30 million per year in disposal and replacement costs

The Problem

Routine Air Force (AF) operations generate 3.5 million gallons of waste aircraft hydraulic fluid each year. Through regular use, accumulation of particulate matter and water requires the disposal of the fluid. The AF needs the development of economical equipment and processes that would allow them to purify aircraft hydraulic fluid.

The Approach

The Air Force Research Laboratory, Materials and Manufacturing Directorate, Airbase and Environmental Technology Division (AFRL/MLQ), Tyndall Air Force Base (AFB), Florida, initiated a hydraulic fluid purification project. As part of the effort, a portable hydraulic fluid purifier manufactured by Pall Aeropower Corporation was evaluated. This purifier uses a vacuum dehydration, spinning disc process to remove water, air, and volatile chlorinated solvents. It incorporates a filtration system to remove particulate matter.

The Pall purifier was shown to effectively remove water, air, volatile chlorinated solvents, and particulates; however, it was not known how the purification process would affect the working properties of the hydraulic fluid. Therefore, an evaluation of the efficiency of the Pall system focused on determining the effect of the vacuum dehydration, spinning disc process on the hydraulic fluid working properties.

Initial Testing

AFRL/MLQ conducted its evaluation at Tyndall AFB, Florida, in 1995. New hydraulic fluid from three different manufacturers was used, as well as used hydraulic fluid from Moody AFB, Georgia; Eglin AFB, Florida; and Dover AFB, Delaware. Each fluid was amended with measured amounts of deionized water and AC fine test dust (particulate). Laboratory results indicated no appreciable difference in the working properties of the hydraulic fluid before and after purification.

Aircraft Hydraulic Pump Wear Testing

Based on these encouraging results, AFRL/MLSE, Wright-Patterson AFB, Ohio, recommended that wear testing be accomplished on aircraft hydraulic fluid pumps to determine the impact of fluid purification on pump life/performance. The F-16 Emergency Power Unit (EPU) and main hydraulic pumps were selected for the pump wear tests. The EPU pump testing with MIL-H-5606 fluid has been completed with no apparent difference in pump performance between pumps operated under load for 1500 hours. Testing of the two F-16 main pumps with MIL-H-83282 for 2000 hours each is in progress. The estimated completion data is May 1999.

Field Testing

Headquarters Air Mobility Command (HQ AMC) recently completed an operational utility evaluation (OUE) at McChord AFB, Washington, on the Pall purifier. This purifier incorporates a state-of-the-art water sensor that automatically shuts off the equipment after a preset level of water removal has been reached. The AMC OUE determined that the purifier sufficiently cleaned the hydraulic fluid without degrading fluid characteristics and determined that the purifier was logistically supportable. This was accomplished by purifying new MIL-H-5606, MIL-H-83282, and MIL-H-87257 that was contaminated with measured amounts of AC fine test dust, deionized water, and PD-680 (a solvent). They purified hydraulic fluid from a portable hydraulic test stand, an in-shop hydraulic test stand, and a C-141 aircraft hydraulic system. The final test report will be published by March 1999.

Pall Aeropower hydraulic fluid purifier applied to aircraft operations

Payoff:

The USAF can use the results of these tests to determine whether or not to use the purified hydraulic fluid in its aircraft. The use of this process could save the USAF approximately $30 million per year in disposal costs and in the cost of new fluids.

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